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# NASA TECH BRIEF

*Marshall Space Flight Center*



## Flaw Detection by Mechanical Resonant Measurement

### The problem:

Standard nondestructive tests of the weld quality of tubes and bars fastened to base plates are expensive and time consuming. In addition, presently available techniques, including dye penetrant and radiographic and ultrasonic inspection, are not sufficiently accurate to detect very small critical flaws in high-strength alloys.

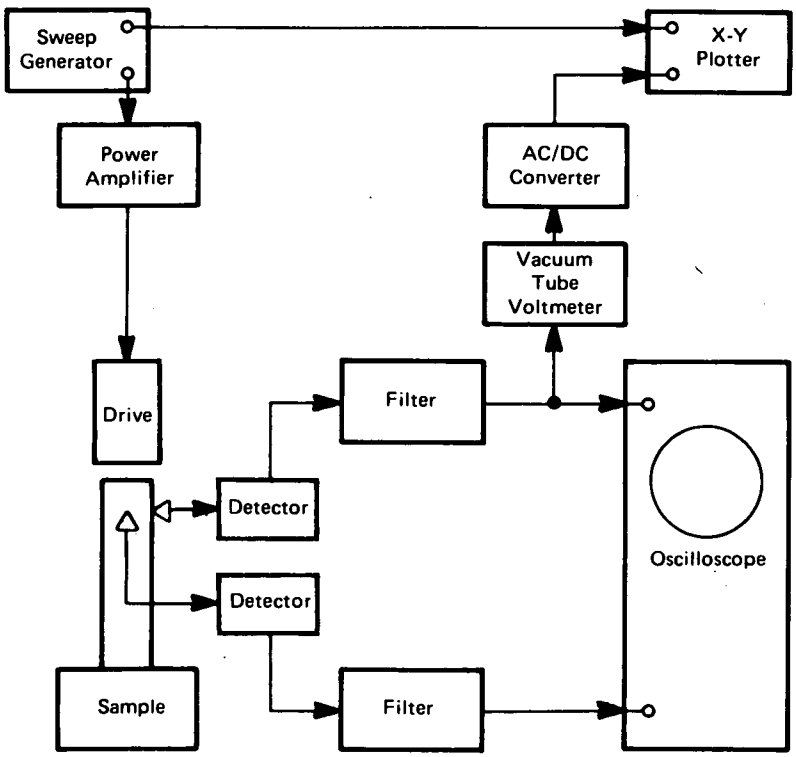
### The solution:

A quick reliable method has been developed for testing this weld quality by means of vibration resonant frequency analysis.

### How it's done:

This testing technique is based on the analysis of varying frequency scan applied to measured samples. Any changes in resonant-frequency harmonics detected in the samples then are used to indicate the size of the fault.

The testing apparatus, as shown in the figure, uses a drive mechanism to apply vibrating force to the sample. Force is applied longitudinally along the axis of the tube or rod under test, to eliminate directionality on flexural vibrations. The flexural vibrations are detected by two phonograph-pickup detectors, mounted at 90°




Testing Apparatus

(continued overleaf)

to each other along the circumference of the tube. In this way, the total motion (amplitude as well as phase relation) of the tube end is fully characterized. If a flaw is present, it will change the local radius of gyration, and hence the frequency for vibrations, in the direction of the defect.

The presence of a defect will show up as a secondary peak near the resonant frequency applied. When viewed on the oscilloscope, the detector which is located directly above the fault will indicate the secondary peak at a higher frequency, whereas the detector orthogonal to the fault will show the secondary peak at a lower frequency. The magnitude of the separation between the primary and secondary peaks indicates the depth and width of the fault.

**Note:**

Requests for further information may be directed to:

Technology Utilization Officer
Marshall Space Flight Center
Code A&PS-TU
Marshall Space Flight Center, Alabama 35812
Reference: B73-10440

**Patent status:**

Inquiries concerning rights for the commercial use of this invention should be addressed to:

Patent Counsel
Marshall Space Flight Center
Code A&PS-PAT
Marshall Space Flight Center, Alabama 35812

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